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## **Space-borne Observations of Intense Gamma-ray Flashes (TGFs) above Thunderstorms**

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### Abstract

Intense millisecond flashes of MeV photons have been observed with space-borne detectors. These terrestrial gamma-ray flashes (TGFs) were discovered with the Burst and Transient Source Experiment (BATSE) aboard the Compton Gamma-Ray Observatory (CGRO) in the early 1990s. They are now being observed with several other instruments, including the Gamma-ray Burst Monitor (GBM) detectors on the Fermi Gamma-ray Space Telescope. Although Fermi-GBM was designed and optimized for the observation of cosmic gamma-ray bursts (GRBs), it has unprecedented capabilities for these TGF observations. On several occasions, intense beams of high-energy electrons and positrons have been observed at the geomagnetic conjugate points of TGFs.

### Bio (Edit/shorten, as needed)

Gerald (Jerry) Fishman is a research astrophysicist with NASA. He was born in St. Louis, Mo. and graduated from the University of Missouri in 1965, with Honors in Physics. He went to graduate school at Rice University, receiving the MS and PhD degrees in Space Science.

While at Rice, he participated in some of the pioneering observations in high-energy astronomy. These included the first balloon-borne observations of objects such as pulsars, black holes, supernova remnants and the Galactic Center. He also led the research group that first observed pulsed gamma rays from the pulsar in the Crab Nebula.

In his work with NASA, he is the Head of the Gamma-Ray Astronomy Group at the NASA/Marshall Space Flight Center, Huntsville, Alabama. His primary research has been in the fields of gamma-ray astronomy, nuclear astrophysics and background radiation in space. He was the Principal Investigator of the Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory. This observatory was the largest scientific spacecraft ever placed into orbit by the U.S. It was launched by the *Space Shuttle Atlantis* in April 1991 and was de-orbited in June 2000. This observatory produced many new scientific results on some of the most energetic and violent objects in the Universe. In particular, BATSE provided unprecedented observations of gamma-ray bursts, which are now one of the hottest topics in modern astronomy. He is presently a Co-Investigator for the GLAST Burst Monitor aboard the GLAST spacecraft, scheduled for launch late this year. The prime objective of this instrument is the study gamma-ray bursts.

Dr. Fishman has also served as the principal scientist on numerous other space projects, going back to Skylab in 1973. He has over two hundred publications in his research area. He received the *NASA Outstanding Scientific Achievement Award* in 1982, 1991 and 1993. He is a *Fellow of the American Physical Society*. In 1994, He was awarded the *Bruno Rossi Prize* of the High Energy Astrophysics Division of the American Astronomical Society in 1994, that Division's highest award.